

REMARKS

Claims 1-23 are pending in the application, of which claims 10-23 have been withdrawn by the Examiner as non-elected. Prior claim rejections have been withdrawn subsequent to Applicant's appeal, and it appears from the present rejection that the Examiner may be misconstruing the invention. Accordingly, in the present communication, Applicant presents further amendments to all of the independent claims in order to provide further clarification of the invention for the Examiner. Applicant respectfully requests that the Examiner contact Applicant's undersigned representative in the event that any further rejection of the claims is to be made so as to further prosecution of the application.

The application has been amended. In particular, language has been incorporated into claims 1, 10 and 20 to clarify that the polyurethane polyol having hydroxyl termination is an oligomer having an average molecular weight distribution of three monomeric units. Support for this language can be found throughout the original application, for example at paragraph [0007] where it is noted that the polyurethane polyols are trimeric or oligomeric polyols prepared as a reaction product of a diisocyanate with a short chain aliphatic diol and a long chain polymeric diol, as well as at paragraph [0018] where the equivalent ratios of the components are discussed in terms of the polyurethane polyol representing an unsymmetrical trimeric species, with specific molar ratios of the monomeric units. Accordingly, these amendments do not constitute new matter within the meaning of 35 U.S.C. § 132.

Claims 1-6 and 9 have been rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by U.S. Patent No. 5,124,424 to Endo et al., or as allegedly being anticipated by U.S. Patent No. 5,326,846 to Nagai et al. Further, dependent claims 7-8 have been rejected under 35 U.S.C. § 103(a) as allegedly being obvious over Endo or Nagai, in view of U.S. Patent No. 5,563,233 to Reich et al. and further in view of U.S. Patent No. 4,264,752 to Watson. Each of these rejections is traversed.

As has been discussed in detail in prior communications, the present invention is directed to prepolymers used in the formation of coating compositions, as well as to coating compositions manufactured from such prepolymers and products coated with such compositions. The prepolymers represent unsymmetrical polyurethane polymers in the form of low viscosity, non-crystalline, substantially 100 percent solids material. In particular, the prepolymers are trimeric or highly oligomeric polyols prepared as a reaction product of a diisocyanate with a short chain aliphatic diol and a long chain polymeric diol. The molecular weight ratios of the specific components (namely the diisocyanate, the short chain aliphatic diol and the long chain polymeric diol) are tailored and controlled during the reaction scheme so as to produce the polyurethane polyol reaction product as a trimeric or oligomeric polyol prepolymer having an average distribution of only three monomeric units. As such, **the polyurethane polyol prepolymer of the present invention is a low molecular weight oligomer having a number average molecular weight of less than about 1000 that has a very low viscosity and no mechanical properties**, due to the lack of polymerization and/or crosslinking at this prepolymer formation stage. Such prepolymers do not crystallize, and exhibit a very high solids content, and therefore represent a viscous product which is pourable without the need for any separate solvent.

Anticipation based on Endo

The Office Action alleges that "Endo discloses a hydroxyl-terminated polyurethane reaction product prepared from an organic diisocyanate, a chain extender, and a polycarbonate polyol", wherein the organic diisocyanate may be an aliphatic diisocyanate and the chain extender includes 1,5-pentadiol. Endo, however, fails to disclose or even suggest the oligomeric prepolymer of the present invention having three monomeric units. Instead, **Endo teaches a thermoplastic polyurethane polymer with a number average molecular weight of greater than 20,000, preferably 30,000 to 60,000, which equates to**

a polymer chain having more than 65 monomeric units. In essence, Endo does not teach a prepolymer, but instead teaches a high molecular weight polymer of about 30% solids, dissolved in a solvent, and used as such for coating applications.

By tailoring the reaction scheme so as to maintain the prepolymer of the present invention as an oligomer having a very high solids content (substantially 100% solids), the prepolymer exhibits a very low viscosity, making it particularly useful as a component for use with additional isocyanate compounds in a secondary reaction scheme to form a crosslinked polymer coating. The low viscosity prepolymer is a syrup-like oligomeric material, which can be crosslinked through this secondary reaction scheme with the additional isocyanate to form a highly solvent resistant polymeric coating. The high solids content of the prepolymer of the present invention makes it particularly useful in this aspect as a prepolymer for secondary reaction schemes in coating applications, and particularly for coating plastic articles. For example, typical polyurethane polymers which are used in secondary reactions with additional isocyanate are typically highly reacted polymers, which have a low solids content and therefore require solvents to maintain their viscosity low enough for coating applications. Such solvents may be harmful to the substrate onto which the secondary coating is being formed, particularly in applications where coatings are used on plastics which can be attacked by solvents. By controlling the reaction scheme to ensure a prepolymer formation, trimeric or oligomeric prepolymers with specific molar ratios can be formed which exhibit a very high solids content and which do not require any such solvents for use in later reaction schemes.

Thus, while Endo may disclose certain components which are well known in polyurethane reaction schemes, the products produced through the teachings of Endo are very different than those claimed in the present invention. Endo fails in any way to teach or suggest a low molecular weight prepolymer in the form of an oligomer having an average of three monomeric units, and instead

teaches a high molecular weight polymer, which essentially has more than 65 monomeric units based on the molecular weight disclosed therein.

The Office Action alleges that "with respect to viscosity and crystalline properties, since the references disclose the same reaction product as presently claimed, it would inherently have the same properties." Again, it appears that the Examiner is misconstruing the reaction scheme that is occurring in the present invention. The present claims identify the polyol prepolymer as being an oligomer having an average of three monomeric units. Merely combining certain reaction products will not assure that such a prepolymer is formed. It is only through specific tailoring of the reaction scheme with specific molar ratios of components that formation of such a prepolymer exhibiting such properties is assured. Merely mixing certain ingredients does not inherently ensure that the product formed from a reaction is the same.

In fact, Endo teaches away from formation of such a prepolymer, in that Endo controls the reaction to ensure polymerization to a degree so as to achieve a certain molecular weight, i.e. in the range of 20,000-130,000, preferably 30,000 to 60,000 (see column 5, lines 42-46 of Endo). Clearly Endo tailors the reaction in order to achieve a certain polymerization, which in turn produces a polymer having a specific chain length. In doing so, Endo teaches entirely away from the present invention where the goal is to provide a prepolymer, not a polymer, and where the prepolymer has as very low molecular weight, represented by its trimeric or oligomeric structure exhibiting only three monomeric units. Again, this is achieved by controlling the reaction scheme with specific molar ratios of components. None of this is taught or suggested in Endo.

Thus, even if Endo discloses similar components, the polymer formed in Endo is entirely different than the prepolymer formed in the present invention. The claims recite specific features, namely a polyol which is an oligomer having an average of three monomeric units, and Endo fails to teach or disclose such features. In fact, the reaction scheme set forth in Endo is not capable of producing the claimed prepolymer, particularly when the intent of

Endo is to produce a polymer having a specific molecular weight which is greater than 20 times that of the claimed invention, considering the monomeric units.

Accordingly, Endo fails to teach each and every limitation of the claimed invention, either explicitly or inherently. Withdrawal of the rejection based on Endo is therefore respectfully requested.

Anticipation based on Nagai

The Office Action further alleges that "Nagai discloses a hydroxyl-group terminated polyurethane reaction product prepared from a diisocyanate, a diol, and a chain extender", wherein the diisocyanate includes an aliphatic diisocyanate, the diol includes polycarbonate diol, and the chain extender includes 1,5-pentadiol. Nagai, however, also fails to disclose or even suggest an oligomeric prepolymer having three monomeric units. Instead, **Nagai as a whole teaches a melt blending of polyacetal pellets, thermoplastic polyurethane pellets and, optionally, a small amount of diol and diisocyanate.** The Office Action specifically points to disclosures at columns 3 and 4 of Nagai, where the preparation of the thermoplastic polyurethane is discussed. Such a thermoplastic polyurethane is very different than the polyurethane prepolymer of the present invention.

Again, as noted above, the prepolymer of the present invention is a low molecular weight material, represented by an oligomer having three monomeric units. As such, it has no mechanical properties, but is a highly solids material with a low viscosity. On the other hand, Nagai teaches a high molecular weight thermoplastic polyurethane. In fact, the overall teachings of Nagai are directed to the use of such a thermoplastic polyurethane in a melt blend with other components. Thus, the thermoplastic polyurethane clearly possesses thermoplastic properties. In fact, Nagai specifically teaches certain properties of the thermoplastic polyurethane at column 4, lines 34-38, including melt flow. Such properties are consistent with a high molecular weight thermoplastic material, which is very different than the low molecular weight oligomeric

prepolymer of the present invention, having an average of only three monomeric units.

The Office Action further contends that, since the reference discloses the same reaction product as claimed, it would inherently have the same properties. As noted above, however, this is not the case. In the present invention, the reaction is specifically tailored with specific mole ratios in order to produce the inventive oligomer. Nagai tailors the reaction to produce a very different product, namely a thermoplastic polyurethane which has a specific melt profile representing its high molecular weight. There is nothing in Nagai which teaches or even remotely suggests that an oligomeric prepolymer with only three monomeric units could be formed. In fact, Nagai essentially teaches away from such an oligomeric three unit structure, in that the only polyurethane component disclosed for use is the thermoplastic polyurethane having a specific melt profile, which is a high molecular weight polyurethane very different than the low molecular weight oligomer with three monomeric units set forth in the present invention.

Accordingly, Nagaia also fails to teach each and every limitation of the claimed invention, either explicitly or inherently. Withdrawal of the rejection based on Nagai is therefore respectfully requested.

Obviousness Rejections

Claims 7-8 are rejected as being obvious based on the combination of Endo or Nagai in view of two additional references, namely Reich and Watson. The Office Action combines these additional references merely with respect to disclosure of specific diisocyanates set forth in dependent claims 7-8. Neither Reich nor Watson, however, address any of the deficiencies of the primary Endo and Nagai references. None of the references disclose a polyurethane polyol precursor in the form of an oligomer having three monomeric units. Instead, all of the references are directed to reaction products which may incorporate conventional polyurethane polymers as a component, wherein the polyurethane

polymer has a specific degree of reaction so as to provide for a high molecular weight. Accordingly, none of the secondary references, when considered in combination with the deficient teachings of the primary references, disclose or suggest the claimed prepolymer polyols.

Based on the above amendments and remarks, Applicant submits that the present application is allowable over the cited documents. Withdrawal of the rejections and reconsideration are therefore respectfully requested.

Should the Examiner have any questions regarding this application, the Examiner is invited to contact Applicant's undersigned representative by telephone at 412-471-8815.

Respectfully submitted,

THE WEBB LAW FIRM

By 
Kirk M. Miles
Registration No. 37,891
Attorney for Applicants
700 Koppers Building
436 Seventh Avenue
Pittsburgh, PA 15219
Telephone: (412) 471-8815
Facsimile: (412) 471-4094
E-mail: webblaw@webblaw.com